

## Discussion

The above-referenced application was filed with the United States Patent and Trademark Office on December 19, 2001. The United States Patent and Trademark Office issued a final Office Action dated May 11, 2004 to which the applicant responded with an Amendment dated July 8, 2004. Shortly thereafter the United States Patent and Trademark Office issued an Advisory Action wherein the proposed amendments to the claims were not entered because new issues were allegedly raised and the proposed claims were not deemed to place the application in condition for allowance. In order to continue the prosecution of this application, the applicants file the attached Request for Continuing Examination, which includes the proposed amended claims from the response to the Final Office Action. Associated with that Request for Continuing Examination is this Preliminary Amendment.

The United States Patent and Trademark Office rejected Claims 1 - 14 under 35 USC §103 as being unpatentable over Wood, et. al. U.S. Patent No. 4,748,145. The USPTO also rejected Claim 14 under 35 USC §102(b) as anticipated by, or in the alternative under USC §103(a) as being obvious over, Wood, et. al. The applicants respectfully traverse each of these rejections.

The applicants have discovered a unique process for preparation of a selective hydrogenation catalyst with a particular composition. The composition of the catalyst has been more

narrowly defined by the amendments to Claim 1 to distinguish the composition of this catalyst and its process of manufacture from the catalysts and processes of manufacture that are disclosed by Wood, et. al.

While the Woods, et. al. conventional procedure for production of a selective hydrogenation catalyst requires reduction of the catalyst *in situ*, the applicants have surprisingly discovered that a catalyst with a specific composition, which is prereduced *ex situ*, exhibits surprisingly improved selectivity, resistance to run away, tolerance to CO concentration swings, and improved performance at higher gas hourly velocities. (See the results shown in Table I - IV of the application and Table I to the attached Affidavit.) These results were surprising because a person skilled in the art reviewing the composition of the catalyst and its process of manufacture would have assumed that a catalyst with this composition would perform in the same manner and not exhibit any improved selectivity, resistance to run away, tolerance to CO concentration swings, and improved performance at higher gas hourly velocities regardless of whether it was reduced *in situ* or *ex situ*. In fact, the applicants have surprisingly discovered that by the use of their prereduced catalyst, apparently different catalyst compositions are produced, which when placed in a selective hydrogenation feedstream, results in improved performance over the prior art catalysts. Thus, the applicants have surprisingly

discovered that their process of prereduction of a specially selected catalyst *ex situ* is critical to the enhanced performance of the selective hydrogenation catalyst of the invention.

The applicants also submit an Affidavit by one of the inventors, Jennifer Boyer, which is attached to this Preliminary Amendment as Exhibit A. As stated in her Affidavit, Jennifer Boyer performed a test on the catalyst of Examples 1 and 3 and Comparative Examples 2 and 4 of the application using a simulated laboratory feed stream found in a front-end ethylene purification reactor. Inventor Boyer discovered from these tests that the Inventive Example catalysts performed surprisingly better than a similar catalysts which had not been prereduced. What was unexpectedly surprising was the difference in improvement in performance when the catalyst that was utilized was a palladium on alumina catalyst with silver added as an additive. As stated in her Affidavit, Inventor Boyer asserts that it was surprising that Inventive Example 3 showed an enhanced improvement over the equivalent commercial embodiment of the catalyst in Comparative Example 4 that had not been prereduced. She also notes that the substantial relative improvement when the catalyst contained palladium on alumina with a silver additive was especially surprising. (See Affidavit para. 10.) The increase in stability, as measured by the increase in Delta T, of the prereduced palladium on alumina with a silver additive catalyst over the non-prereduced

catalyst of the same composition (A Delta T of 14°F) when compared to the increase in Delta T when the catalysts being compared comprised palladium on alumina (A Delta T increase of only 4°F) was substantial. This substantial improvement was not anticipated. Accordingly, Inventor Boyer asserts that it is surprising that a prereduced catalyst with the particular composition, as now specifically claimed in Claim 1 and the other claims of the application, would perform better than non-prereduced catalyst with a similar composition and especially surprisingly that it showed such a substantial relative improvement over a selective hydrogenation catalyst containing merely palladium on alumina without the silver additive, even if prereduced.

**Wood, et. al.**

The sole reference cited against all of the claims of the application is Wood, et. al. Wood, et. al. disclose a catalyst composition comprising a catalytic material placed on a support, wherein the support is prepared by depositing a metal alkoxide on a core material. The catalyst support can be used as a common carrier for various catalysts of different compositions for a number of different catalytic procedures, including methanation (col. 5, line 62), olefin metathesis (col. 6, line 37), carbonylation (col.8, line 27), and hydrogenation (col. 14, line 28 at sec.).

The primary focus of Wood, et. al. is directed to the composition of the support for various catalysts. A person skilled in the art reviewing the disclosure of Wood, et. al. would have understood that their disclosure was of a support material, which has been modified by the addition of an alkoxide (see Claim 1 - 16). In fact, the use of this alkoxide support material was the sole element utilized to distinguish Wood, et. al. from the prior art. The remaining disclosures of Wood, et. al. merely showed the utility of the Wood, et. al. support material for various types of catalysts.

The carrier that is disclosed in Wood, et. al. is entirely different from the catalyst carrier as claimed in the application. The USPTO asserts that the applicants' support, which is chemically different from those which are disclosed in Wood, et. al., are "old and known as catalyst supports." The applicants do not argue with this assertion. However, the point of the applicants' previous argument was that the novelty in Wood, et. al. was focused solely on the composition of their support. The particular catalyst material and additives which are disclosed by Wood, et. al. are not novel. In fact, the only Wood, et. al. claims to composition of any catalytic material are in Claims 2 and 16, where the active catalysis material is a group VIII metal. In reviewing a reference what is important is what is taught to a person "skilled in the art" who reviews that reference. A person skilled in the art

reviewing the disclosure of Wood, et. al. would only be taught the composition of a new support material.

In contrast, the claims of the application, as currently pending, are focused primarily on a process for the production of a specific type of catalyst, a unique selective hydrogenation catalyst. As currently amended, the claims are narrowly focused to a specific selective hydrogenation catalyst prepared by a particular process, wherein the catalyst has a particular composition comprising palladium and silver, wherein the ratio of the silver to the palladium is within a particular range.

In response to the assertion that the applicants' invention was focused primarily on a process for the production of a specific type of catalyst, the USPTO asserts that this is not a persuasive argument in view of the fact the "applicants purchased the catalyst" and that "means that they did not formulate it". (See attachment to Advisory Action, line 3.) In fact, this is not correct. The Assignee and the applicants specifically formulated each of the catalysts. (Note the assertion to that effect in the Affidavit of Inventor Boyer at paragraph 5.) Further, in the application it states at page 18, line 25 through page 19, line 1 as follows, "A commercial catalyst was acquired from Süd-Chemie, Inc. with a product name of G83A." The Assignee of this invention is Süd-Chemie, Inc. This sentence in the Example merely means that the catalyst, prior to processing by the inventive process, is a

commercial catalyst that is produced and sold by Süd-Chemie, Inc. It is not purchased from any other party, but is manufactured by the Assignee. This same assertion applies to the catalyst G83C as discussed in Examples 3 and 4. See page 19, line 24 - 25. Thus, the assertion by the USPTO that the distinction based on the composition of the catalyst is not persuasive because the catalyst is acquired from a third party is not supported by the record.

The applicants specifically assert that they have discovered that the prereduction of a particular catalyst using the process as claimed in the application produces a new catalyst which performs surprisingly better than when the catalyst is not prereduced. Further, and of even more importance, is the assertion made by Inventor Boyer in her Affidavit of the surprising improvement shown in the prereduction of the catalyst of Inventive Example 3. (See paragraph 8 of the Affidavit.) This improvement was certainly surprising and disclosed a significantly greater improvement than was shown for the prereduced palladium only selective hydrogenation catalyst.

The USPTO has inherently recognized that Wood, et. al. fail to teach this particular composition. The USPTO has also recognized that there is no teaching of any preference for the combination of palladium and silver within the claimed ranges. Certainly there is no teaching of the combination of the particular quantities of silver and palladium with the particular ratio of silver to

palladium. Further, there is clearly no teaching of the surprising improvement when the catalyst with the particular combination of particular quantities of silver and palladium with a particular ratio of silver to palladium was compared with the catalyst prepared using exactly the same process without the silver as an additive. While it might be anticipated that the silver would enhance the performance of the palladium catalyst, it could not have been anticipated the degree to which the catalyst would outperform the nonprereduced catalyst, as alleged in the Affidavit of the Inventor, Jennifer Boyer. Notwithstanding the clarity of this assertion, the USPTO argues that "using promoters with it is an obvious expedient to make a more effective catalyst." The applicants respectfully assert that the USPTO has read too much into the disclosure of Wood, et. al. A person skilled in the art would not have been taught all of the components and process steps that are not disclosed by Wood, et. al. including the following:

1. The requirement that the preferred catalyst composition is prereduced and placed under an inert atmosphere prior to utilization by the consumer. In fact, in the numerous preparations disclosed in the examples of Wood, et. al. from col. 17 through 25, none teaches prereduction and placement of a catalyst under an inert atmosphere. Note particularly that the Wood, et. al. examples, which disclose a process for the preparation of a selective hydrogenation catalyst, i.e. Examples 10 and 11. These



examples specifically fail to disclosed prereduction and placement of a catalyst under an inert atmosphere. (See col. 23 - 24). Thus, Wood, et. al. failed to recognized the criticality of this process step to produce this specific type of catalyst. In fact, by failing to disclose the requirement of placing a prereduced catalyst under an inert atmosphere, Wood, et. al. specifically teach away from this critical process step. Thus, a person skilled in the art would not have been taught by Wood, et. al. to prereduce a selective hydrogenation catalyst and then store that prereduced catalyst under an inert environment prior to its use.

2. Wood, et. al. fails to teach the preference for silver as an additive in the selective hydrogenation catalyst. While, Wood, et. al. disclose the possibility that group IB metals may be used, none are used in any of the Examples. Further, silver specifically is not disclosed as an additive in any of the examples. Thus, there was no recognition by Wood, et. al. of the requirement of including silver as an additive for palladium on a selective hydrogenation catalyst which was prepared by prereduction *in situ*. Clearly there was no recognition by Wood, et. al. of the substantial improvement in performance of a prereduced catalyst over a nonprereduced catalyst of the exact same composition. Further, this substantial improvement clearly could not have been anticipated as it exceeds substantially the improvement when the catalyst that is prereduced is merely palladium on alumina, as

shown in the Table 1 of the attached Affidavit. In fact, by failing to include this additive, a person skilled in the art would be taught away from necessity of its presence in a selective hydrogenation catalyst.

3. In addition to failing to recognize the importance of the use of silver as an additive to palladium for a selective hydrogenation catalyst, Wood, et. al. obviously also fail to recognize the particular quantity of silver that should be used and the specific ratio between the silver and the palladium that must be present. See Claims 1, 23, 24, 25 and 27. Accordingly, there is no motivation or suggestion in Wood, et. al. to combine these materials, nor any motivation or suggestion to combine them in the amounts, as claimed, and certainly no motivation or suggestion to combine them in the ratios that are claimed.

**Prima facie Obviousness**

The USPTO has established a strict three step process for proving *prima facie* obviousness under 35 USC §103, as explained in MPEP 2142-213. Failure to satisfy these steps means that obviousness has not been shown. The first step requires the Examiner to set forth the differences in the claim over the applied reference or references and to explain the suggestion or motivation that is present in the reference which would encourage a person skilled in the art to modify the reference to disclose the subject matter of the claims. The Examiner in this Office Action has

acknowledged that there is no teaching of preventing reoxidation. The Examiner has also acknowledged that the particular catalyst promoters are not taught with the particular quantities and ratios of the additives. The Examiner has also acknowledged that the process of storing the material under a non-reducing gas is not taught. "Wood makes the same catalyst even though possibly stored differently." Page 3.

Recognizing these deficiencies in the cited reference, the second step in the proof of *prima facie* obviousness requires the Examiner to prove that the proposed modification of the reference would be likely to arrive at the claimed subject matter. In this specific situation a number of additional components and process steps, which are not specifically disclosed, would need to be added to the teaching of Wood, et. al. before the applicants' invention is taught. For example, there must be a teaching to prereduce the catalyst and store the reduced catalyst in a non-reducing environment. This is clearly not obvious as it would be more expensive and more difficult than not to prereduce and storing.

The Examiner asserts that prereduction is simply an "economic tradeoff". If this were true, prereduction would be taught as an obvious alternative in Wood, et. al. In fact, neither Wood, et. al. nor any other reference teaches this process step as the preferred or even a preferred process. Further, the applicants have surprisingly discovered that prereduction is especially useful

for a catalyst of this particular composition. This composition is clearly not suggested by Wood, et. al.

The Examiner has also not shown how the differences in the composition of the material, as claimed, from the material disclosed in Wood, et. al. would be obvious, including not only the precise composition, but the quantity and ratio of the individual components of the catalyst. Further, the Examiner has not shown how the especially surprising improvement when the prereduced catalyst specifically comprises silver as a promoter on a palladium impregnated catalyst would be anticipated.

The Examiner also asserts that the tables in the specification do not support the claim based on the alleged criticality of the composition. The applicants have limited the claims to only prereduction of a palladium catalyst with silver additive, wherein the quantities and ratio of palladium and silver are within narrow ranges. It is not necessary to place any further limitations on the composition of the catalyst as no portion of the claimed range is disclosed or suggested by Wood, et. al.

The third step of the *prima facie* test requires the Examiner to explain why the proposed modification would be obvious and how it teaches each claim limitation. To satisfy this requirement, when the deficiencies in the cited reference are so significant and so numerous, the Examiner has merely stated that all of these nondisclosed elements of the invention would be "obvious

expedients". In fact, the Examiner uses that argument to describe six particular missing claim elements which are not disclosed in Wood, et. al. The applicants respectfully assert that all of these differences could not be "obvious expedients." The applicants respectfully assert that the USPTO has failed to satisfy its burden to establish *prima facie* obviousness.

In addition to satisfying the above-described three-part test, the USPTO is required to identify where in Wood, et. al. there is a motivating suggestion to utilize each of these missing claims elements. As none of these claim elements are specifically disclosed or suggested in Wood, et. al. because the focus of Wood, et. al. was not on the process of production of the catalyst or its composition but on the preparation of the catalyst support, the USPTO has failed in its proof. Specifically, there is no statement in Wood, et. al. of a preference for the storage of a prereduced catalyst under a non-reducing material, especially as that would be a more expensive process. There is no statement that the addition of silver to palladium would produce a surprisingly better and higher performing selective hydrogenation catalyst, especially as this addition would be more costly. There is no statement or suggestion in Wood, et. al. of any motivation which would teach a person skilled in the art to choose the particular quantities or the particular ratios of silver to palladium, which are claimed in the claims of the application.

In In re Jones, 958 Fed. 2d 347, 21 USPQ2d 1941, 1944 (Fed. Cir. 1992, citing In re Lalu, 747 Fed.2d 703, 705, 223 USPQ 1257, 1258 (Fed. Cir. 1984), the Court stated that "[t]he prior art must provide one of ordinary skill in the art the motivation to make the proposed... modification needed to arrive at the claim compound." The USPTO has failed to disclose any suggestion or motivation in Wood, et. al. to teach any, and certainly not all, of the above-referenced modifications to what is disclosed in Wood, et. al.

Moreover, the USPTO has failed to prove that the modifications that are necessary to be made to the catalyst of Wood, et. al. to arrive at the catalyst, as claimed, using the process as claimed, is a "desirable" modification. The "desirability" of the motivation must also be proved to establish *prima facie* obviousness

The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make modification obvious unless the prior art suggested the desirability of the modification. In re Fritch, 922 Fed.2d 1260, 23 USPQ2d 1780, 1783 -1784 (Fed. Cir. 1992).

Once again it is absolutely clear that none of the modifications that are necessary to the catalyst of Wood, et. al. or the process of manufacture of the catalyst of Wood, et. al. to result in the catalyst as claimed by the process, as claimed, could be termed by a person skilled in the art to be "desirable." Only the applicants' surprising discovery of the desirability of these modification resulted in the improvements in the catalyst and in the process of its manufacture. The USPTO has not proved that

there was any "desirability" in making those modifications.

In addition, the USPTO has failed to show that the motivating suggestion to make the various changes either to the process or the composition of the catalyst, as claimed, are "explicit" and not merely what are referred to as "obvious expedients."

... Invention can not be found obvious unless there was some explicit teaching or suggestion in art to motivate one of ordinary skill to combine elements so as to create same invention. Winner International Royalty Corp. v. Wang, 48 USPQ2d 1139, 1140 (D.C.D.C. 1998) (Emphasis supplied).

The USPTO has acknowledged that all of these differences between the invention and Wood, et. al. are not specifically disclosed by Wood, et. al. Thus, it is clear that they can not be "explicitly" disclosed. Thus, the USPTO has failed to satisfy the requirement for proof of obviousness, even under the guidelines set in its own MPEP.

CONCLUSION

Based on the failure to prove "*prima facie*" obviousness, the applicants respectfully request that the rejection of the claims, as amended, be withdrawn and that a Notice of Allowability be issued. If there are any questions concerning this Response to the Office Action, please contact applicants' counsel.

Respectfully submitted,



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CERTIFICATE OF SERVICE

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Date: September 10, 2004

Holly Hart

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## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:
Steven A. Blankenship, et al.	:
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Serial No.: 10/025,663	:
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	Group No. 1754
Filed: December 19, 2001	:
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Attorney Docket No.: P-1106	:
	Examiner: Stuart L.
	Hendrickson
	:
For: PROCESS FOR PRODUCTION AND	:
DISTRIBUTION OF A PREREDUCED	:
SELECTIVE HYDROGENATION	:
CATALYST	:
	:
	Confirmation No. 6529

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AFFIDAVIT UNDER 37 CFR 1.132

Jennifer Boyer, being duly sworn, does hereby depose and states as follows:

1. I am co-inventor of all claims of patent application Serial No. 10/025,663, which was filed on December 19, 2001.

2. This application is entitled "PROCESS FOR PRODUCTION AND DISTRIBUTION OF A PREREDUCED SELECTIVE HYDROGENATION CATALYST."

3. I am co-inventor of this application with Steven A. Blankenship, Andrzej Rokicki and James E. Fried, Jr.

4. All rights to each of these applications are assigned to Süd-Chemie, Inc. ("SCI"), for which all inventors are currently employed.

5. In order to compare the process of the invention with the

conventional process for preparation of a selective hydrogenation catalyst, a number of Examples were run which were included with the application. (See pp. 18 - 30 of the application.) Tests on the effectiveness of four of these catalysts in a selective hydrogenation reaction have now been run. All of the catalysts that were utilized, both in the Examples in the application and in these tests, were manufactured by the Assignee of this invention, Süd-Chemie, Inc. None were purchased from any third party.

6. The catalysts of inventive Example 1 and 3 and Comparative Examples 2 and 4 from the application were tested using a laboratory simulated feed stream found in a front-end ethylene purification reactor that employs de-ethanizer separation technology in front of a selective hydrogenation reactor. The simulated process feed stream comprised 100 ppm  $C_2H_6$ , 45%  $C_2H_4$ , 1500 ppm  $C_2H_2$ , 20%  $H_2$ , 250 - 300 ppm CO with the remaining gas comprising  $CH_4$ . A moderate GHSV space velocity of 7000 was used at a pressure of 500 psig. 25 cc of each catalyst sample were placed in a catalyst bed for testing. The catalysts were evaluated in a bench scale 3/4 in. i.d. reactor tube. The catalysts were tested for eight (8) hours with the temperature increasing starting at 87°F (30°C). Data from the test was taken every 20 minutes as the temperatures increased at 4°F intervals. The "clean up" temperature ( $T_1$ ) when the exit  $C_2H_2$  level was less than 25 ppm was noted. The temperature was increased past  $T_1$  until "runaway" conditions occurred ( $T_2$ ), i.e. the temperature where greater than a

4% hydrogen loss occurred.  $T_2$  minus  $T_1$  ("Delta T") is a measure of selectivity. (A higher Delta T indicates higher selectivity and better thermal stability.) The results of the testing are shown in Table I to this Affidavit.

7. In reviewing the results of Table I, the prereduced palladium/silver catalyst of Inventive Example 3 showed the greatest stability as indicated by the highest Delta T measurement with a difference of 18°F between  $T_1$  and  $T_2$ . Inventive Example 3 also showed better stability than a similarly prereduced palladium and alumina catalyst, as proved by a Delta T of only 14°F (128°F - 114°F).

8. Each of the Inventive Examples showed increased stability over the nonprereduced catalyst of the same composition. Specifically, when Inventive Example 1 was compared with comparative Example 2, the improvement in Delta T was 4°F. When Inventive Example 3 was compared with comparative Example 4, Inventive Example 3 showed a 14°F improvement in Delta T. Not only did the catalyst of Inventive Example 3 comprising palladium, silver and alumina show a significantly better Delta T than the nonprereduced catalyst i.e., a 14°F difference, it showed a better Delta T than Inventive Example I, wherein the catalyst comprised palladium on alumina.

9. Each of these improvements was surprising as one would have anticipated that catalysts of the same composition when placed

in a selective hydrogenation system would perform in approximately the same manner, whether prereduced or not. It was thus surprising that the prereduced catalyst (Invention Examples 1 and 3) preformed better than the nonprereduced Examples (comparative Examples 2 and 4).

10. It was especially surprising that the increase in Delta T of Inventive Example 3 containing palladium with a silver additive over the nonprereduced catalyst of the same composition (Comparative Example 4) was substantially greater than the increase in Delta T of Inventive Example 1 containing merely palladium on alumina over the nonprereduced catalyst of the same composition (Comparative Example 2). (A Delta T increase of 14°F for the prereduced palladium and silver on alumina catalyst vs. only 4°F for the prereduced palladium on alumina catalyst (See Table 1)). These results were not anticipated.

The affiant makes no further statement.

Jennifer Boyer  
Jennifer Boyer

STATE OF KENTUCKY     )  
                                      ) SS  
COUNTY OF JEFFERSON )

Acknowledged, subscribed and sworn to before me this 10th day of SEPTEMBER, 2004, by Jennifer Boyer to be her act and deed.

My commission expires: JANUARY 23, 2006

[Signature]  
NOTARY PUBLIC, STATE AT LARGE, KY



Table I

Run	Catalyst	T <sub>1</sub> (°F)	T <sub>2</sub> (°F)	T <sub>2</sub> - T <sub>1</sub>
Invention Example 1	G83A (SCI) Pd/Al <sub>2</sub> O <sub>3</sub> Reduced in 100%H <sub>2</sub> at 200°F (93°C) for 1 hour, stabilized in N <sub>2</sub>	114	128	14
Comparative Example 2	G83A (SCI) Pd/Al <sub>2</sub> O <sub>3</sub>	140	150	10
Invention Example 3	G83A (SCI) Pd/Ag/Al <sub>2</sub> O <sub>3</sub> Reduced in 100%H <sub>2</sub> at 200°F (93°C) for 1 hour, stabilized in N <sub>2</sub>	106	124	18
Comparative Example 4	G83C (SCI) Pd/Ag/Al <sub>2</sub> O <sub>3</sub>	103	107	4